Special Study Report

PINE SWAMP SITE PROGRAM
HAMDEN, CT.

For
Olin Corporation
Stamford, CT.

August 1983

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

ATTACHMENT E

PC: B E Hill (from CHC) 8/23/83

Pine Swamp

Olin

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August 19, 1983

HAND DELIVERED

Robert E. Moore
Assistant Deputy Commissioner
Department of Environmental Protection
Water Compliance Unit
165 Capitol Avenue
Hartford, CT 06106

Dear Mr. Moore:

Herewith enclosed please find two copies of a report, entitled "Pine Swamp Site Program," prepared by the environmental engineering firm of Malcolm Pirnie, Inc. of White Plains, New York, dated August, 1983, in connection with property the Olin Corporation owns in Hamden (hereinafter called "Pine Swamp"). This submission is being made consistent with our discussions during the meeting in your office on June 21, 1983. During the course of these discussions, as you will recall, we agreed that Olin would submit a detailed monitoring and remedial plan to assure that the current situation at Pine Swamp will not create a threat to the environment or public welfare.

Olin continues to believe that exhumation of the waste at Pine Swamp is neither the proper environmental response to the situation nor is it required by State law, regulation or policy. To this end, and with the concurrence of the Department of Environmental Protection (DEP), Olin retained the services of Environmental Research and Technology, Inc., Concord, Massachusetts to investigate the impact of Olin's past waste disposal, at Pine Swamp, on the quality of surface and groundwater in the vicinity of this property. Based on this investigation, ERT concluded that ". . . past waste disposal activities at the Pine Swamp site have not and are not anticipated to adversely affect Lake Whitney or downgradient drinking-water supplies." (See page iii of ERT's June, 1982 report entitled "Phase II Site Investigation at Pine Swamp.")

Notwithstanding the ERT report, the DEP had some reservations regarding these recommendations. In order to resolve any question about Olin's proposals, we elected, again with your concurrence, to retain the services of Malcolm Pirnie to both review the ERT investigation and recommendations as well as to take a new look at the Pine Swamp matter, and (if appropriate) make further recommendations and proposals. As noted in the enclosed report, Malcolm Pirnie also has reached ERT's main conclusion; namely, covering and monitoring, the waste disposal site at Pine Swamp, is the proper course of action to take in light of the rather remote threat (potential or actual) to the downgradient surface and groundwater systems. Viewing this another way, Malcolm Pirnie saw no

need for an expensive and unnecessary effort to exhume these wastes and strongly believes the proposed monitoring system will confirm our view that the current situation presents no public health or environmental threat to the Lake Whitney watershed.

Furthermore, our review of Connecticut's environmental laws and regulations suggests that the DEP, although it has substantial authority in this area, is obliged to establish, as a condition precedent for administrative or judicial action, that the targeted condition "reasonably can be expected to create a source of pollution to the waters of the State." Admittedly the term "pollution" is broadly defined; however, we believe that the data generated by Olin's two independent consultants clearly proves that the proposed action will prevent any contamination of the Lake Whitney water supply. At the very minimum, if there is any unexpected movement of pollutants toward this watershed area, the monitoring wells will act as an early warning system so as to permit Olin, with the concurrence of the DEP, to take the required action.

In short, we believe that the DEP's view of the enclosed report will convince you that the proposed action is, in fact, the proper action for Olin to take. We, of course, are ready and willing to work with your office to implement these proposals with dispatch in order to arrive at a mutually acceptable action plan thereby removing any doubt concerning the continued environmental safety of the Lake Whitney watershed area.

I look forward to receiving your comments on the enclosed Malcolm Pirnie report. We also wish to confirm a meeting with you and/or your staff, along with representatives from Malcolm Pirnie, to discuss their proposals and recommendations in greater detail, for August 29 at 1:30 p.m. at your offices.

Thank you for your continued cooperation in and attention to this matter.

Sincerely,

Allyn Carnam

Allyn Myles Carnam
Counsel-Regulatory Affairs

AMC/deh
Enclosure

cc: P. B. Duff
C. L. Knowles
M. B. Sokolowski

August 16, 1983

Mr. Paul Duff, Manager
Environmental and Energy Affairs
Olin Corporation
120 Long Ridge Road
Stamford, CT 06904

Dear Mr. Duff:

As recently discussed, we have prepared a report on the Pine Swamp Site. After reviewing available information, we believe that a ground-water and surface water monitoring program combined with repair of the broken storm sewer and covering of surficial battery waste deposits constitutes a balanced, reasonable set of actions to continue to protect waters of the State at and adjacent to the site. Our review has focused on the battery waste area and the adjacent cage burning area.

If you have any questions, please do not hesitate to contact myself at (914) 694-2100 or Mr. V. Uhl at (201) 845-0400.

Very truly yours,

MALCOLM PIRNIE, INC.

Richard P. Brownell

R.P. Brownell
Vice President

Vincent W. Uhl, Jr.

V.W. Uhl
Manager,
Hydrogeological Services

MALCOLM PIRNIE

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I. INTRODUCTION

Olin Corporation owns the Pine Swamp site in Hamden, CT which is adjacent to Lake Whitney, a water supply reservoir. Historically the site was used for the storage of gunpowder. In more recent times dry cell battery wastes were disposed on the site into the early 1960's and some organic wastes were burned on-site until about 1966. Portions of the site along Putnam Avenue were sold to other industries prior to 1967.

In 1980 Olin retained the services of Environmental Research and Technology Inc. (ERT) to investigate the site. In January 1981 ERT prepared a report entitled "Environmental Investigation of Pine Swamp". They also prepared a report entitled "Phase II - Site Investigation at Pine Swamp" in June 1982. During the course of these investigations Olin was coordinating its efforts with the Connecticut Department of Environmental Protection (DEP).

In July 1983, Olin retained the services of Malcolm Pirnie, Inc. (Pirnie) to:

- review previous investigations at the site; conduct a site visit.
- determine the efficacy of a monitoring program and provide the specific details of any recommended program.
- consider the need for other actions on the site.
- prepare a concise document summarizing our findings.

This report briefly addresses the hydrogeologic/hydrologic conditions at the site as they relate to our proposed overall site strategy. The site strategy was used as a basis to develop the details of our recommended program.

II. HYDROGEOLOGIC/HYDROLOGIC CONDITIONS

Regional Hydrogeology

The site is located in the Mill River Basin. The thick sequence of glacial (Ice-Contact) deposits in the area along Mill River (characterized by dark-red or reddish-brown sands and variability of grain size and sorting) forms the most productive water-bearing unit in the basin. Depth to bedrock at and near the site ranges from less than 50 feet to greater than 200 feet.

The glacial aquifer system at and near the site is very permeable (pumping test information for the Whitney Center well indicates an aquifer transmissivity of 130,000 gpd/ft.) and is able to provide large quantities of water to wells. Ground water occurs under unconfined conditions within this aquifer system.

Regional ground-water flow condition within the glacial aquifer system have not been defined in any detail in previous studies by the United States Geological Survey and others.

Site-Specific Hydrogeology

The available data suggest that the glacial aquifer system attains its maximum thickness at and adjacent to the Pine Swamp site. Site specific ground-water flow conditions have not been adequately characterized due in part to an insufficient number of both monitoring/observation wells and measurement events. Flow conditions are further complicated by several pumping wells near the site (e.g., Leeds, Whitney Center and Himmel).

The January 1981 ERT study suggests that the ground water discharges to the several ponds on-site and flows into Lake Whitney as surface water. The system probably discharges modest quantities of ground water to the on-site ponds (i.e., the shallow flow component in the dry-cell battery waste

area); in our opinion, however, the principal flow component is most likely toward Lake Whitney (regional[1] ground-water discharge point). In the area of the battery waste ERT estimated that 0.01 gpm (on an annualized basis) flows through the dry-cell battery waste and enters pond A. While, we believe that this quantity may be higher, additional data are required to refine this estimate. Similarily, the available data appear to be insufficient to characterize adequately ground-water flow conditions (lateral and vertical) on and adjacent to the site.

Possible Supplemental Data Requirements

DEP and Olin have raised some questions about the fate of the materials disposed of at, or possibly adjacent to, the site and to a certain extent detected in the ground water on site. Development of a better understanding of the ground-water flow system dynamics would be necessary to resolve these concerns, unless the materials of interest were to be removed. The following data may be required:

- Better definition of vertical and horizontal flow components.
- The effect of nearby pumpage on flow conditions.
- Permeability of glacial deposits.
- Water balance.

Ground-Water Data

Two ground-water quality concerns at the Pine Swamp site are addressed in this report: metals, primarily lead; and non-priority pollutant organics primarily tertiary butyl alcohol and tetrahydrofuran. The source of metals is an area

1. For the purposes of this report regional is defined as those portions of the flow system which traverse the length of the Pine Swamp Valley.

southwest of pond A used for the disposal of dry-cell batteries. The waste is situated in a former topographic depression and ERT data indicate that the wastes are 90% in the water table. While ground-water quality around the dry-cell battery wastes is generally good, some data indicate that lead values may be above the drinking water standard in one well (ERT 17).

The data collected by ERT, Connecticut DEP, and Olin differ in the concentration of lead dissolved in ground water at the site. Two of the three sample sets only showed one lead value of interest.

LOCATION INFORMATION		DEP SAMPLE ppb		OLIN/ERT DECEMBER 1981 PHASE II SAMPLE ppb		MAY '83 OLIN RESAMPLE ppb	
Well Number	Well Depth	Value	Detection Limit	Value	Detection Limit	Value	Detection Limit
ERT 9	5'	300	?	ND	100	7.5	7.5
ERT 17	7.5'	940	?	180	100	132	7.5
ERT 20	15'	280	?	ND	100	24	7.5

ERT initial sample was analyzed on a flame-type atomic adsorption unit that had a reported detection limit of 100 ppb. Olin resampled each well and supervised the reanalysis on a flameless graphic furnace unit that has a 7.5 ppb detection limit. It is unclear why the DEP values are so different from the ERT and Olin results.

While a possible source of the lead in well ERT 17 is the dry-cell battery waste, it appears that if this is the case no evidence indicates that the lead is migrating toward Lake Whitney at significant levels. After 15 years of contact with ground water, significant leaching would have already occurred if it was going to occur.

While the sources and distributions of non-priority organics (tertiary butyl alcohol (TBA) and tetrahydrofuran (THF) in the cage burning area are undefined, a review of the data indicate that the highest measured concentrations in ground water are 5.3 mg/l for TBA (ERT 3) and 1.3 mg/l for THF

(ERT 16). While information on acceptable levels of TBA and THF in ground water is scant, USEPA Multimedia Environmental Goals for Environmental Assessment Series (MEG) published in 1979 suggest permissible concentrations in water at levels of 4.1 mg/l for TBA and 8.1 mg/l for THF. There does not seem to be any evidence of these materials migrating toward Lake Whitney at significant levels (the MEG levels) from areas where they are currently detected. As noted earlier additional work appears necessary to better define ground-water conditions in this area.

Rain/Storm Flows

Previous estimates have been made by ERT for street drain water input to the site. In regard to the areas of interest addressed in this report, the rain/storm water components have the most significance relative to the battery waste area. Based on the survey of the site by ERT, the area occupied by the battery wastes is estimated to be approximately one acre. About 50 to 75 percent of the rainfall normally falling on that flat area should percolate to ground water. On this basis about 1 gpm of water (on an annualized basis) might be percolating downward into this acre from precipitation. By comparison, rough estimates indicate that the broken storm sewer drains an area of 10 to 20 acres, much of it paved. The storm sewer may be spilling 3 to 6 gpm (on an annualized basis) onto the site. If 40 percent of this percolated into the ground (i.e. most will runoff to the pond) , this source of water would be about same as the total of the other inputs/throughputs of water; i.e., direct rainfall and local horizontal ground-water movement. Hence, repair of the broken storm sewer might be expected to have a noticeable impact upon whatever ground water movement is occurring through the battery waste pile. This repair would seem to be a more logical action than capping the site. Since there is no evidence that

signficant amounts of metals are migrating toward pond A via the ground water, even the repair of sewer would be questionable if it were not for the surface erosion capability of water discharged from the broken pipe.

III. OVERALL SITE STRATEGY

Our review of existing information indicates that non-priority pollutant organics and lead are dissolved in the ground water to the west of pond A and metals in the soils in the battery waste area. No evidence indicates any imminent hazard from these wastes and hence no impelling reason to remove them. A program could be developed which would monitor how ground water conditions, which have taken over fifteen years to develop, change over the next few years. In this way documentation would be developed to show more clearly that no impacts have occurred or will occur, or to devise appropriate remedial actions to mitigate an impact if significant changes in ground-water quality are apparent.

The overall site strategy is proposed to consist of three elements.

- o monitoring strategy
- o surface water control
- o Other site control

Monitoring Strategy

Metals

Initially, ground water will be sampled for concentrations of Pb, Cd, Zn, and Mn twice a year (spring and fall) to detect maximum infiltration effects. If the quality of the water is in compliance with primary drinking water standards for three years, the sampling frequency will be decreased to once per year (in the spring to detect maximum infiltration effects). If water quality at the sampling points is in compliance for three successive years, sampling will be terminated. Alternately, if samples exceed the primary drinking water standard on any event, monitoring will be increased to a quarterly frequency. Should three successive quarterly sampling events detect metal concentrations in excess of the primary drinking water standards, a remedial

action program would be developed for review and aprpoval by DEP. The three-year time frame is chosen because that is the approximate time required for ground water from the dry-cell battery waste area to flow to the two downgradient clusters. The clusters are tentatively located so that a greater time of travel exists between the clusters and the Lake than between the waste area and the clusters.

Non-Priority Pollutant Organics

A similar strategy to that for metals will be implemented for the non-priority pollutant organics. Initially, sampling will be conducted biannually. If total non-priority organics concentrations do not exceed 10 mg/l for three successive sampling events, the frequency will be reduced to once per year. The 10 mg/l level roughly represents the sum of the MEG values for TBA and THF. Monitoring will be terminated if the concentration of total non-priority pollutant organics is less than 5 mg/l for three successive annual sampling events; this level (5 mg/l) was chosen as it would show that a decline from 10 mg/l had occurred. Conversely, if non-priority organics exceed 10 mg/l for any sampling event, the sampling frequency will be increased to quarterly. If non-priority organics exceed 10 mg/l for three successive sampling events, a remedial action program would be developed for review and approval by the DEP.

Surface Water Control

To control surface erosion the broken 24-inch storm sewer should be repaired or replaced for a distance of about 400 feet. Material excavated from the pipe trench which contains dry-cell battery wastes should be mixed with lime to stabilize it. It should then be disposed of in a local landfill as a non-hazardous industrial waste. It is estimated that the volume of this material would be about 110 cubic yards.

Other Site Controls

In our opinion the dry-cell waste battery area should be cleared and grubbed, covered with fill and reseeded with grass. This action is intended mainly to improve the appearance of the site.

IV. MONITORING PROGRAM

The monitoring program described below is designed to monitor the metal and non-priority pollutant concentrations and trigger actions if concentrations are detected which threaten public health or the environment.

The program is also designed to provide better definition of ground-water flow conditions which are thought to be complex due to:

- Pumping in the area has probably altered directions of ground water flow to an extent.
- The presence of localized shallow ground-water discharge points (i.e., on-site ponds) and, as such a ground-water flow system which probably consists of a series of small, localized flow systems superimposed on a larger, deeper, valley-wide flow system.

Further, prior to any additional activities, Olin and Connecticut DEP should conduct a split sampling of wells ERT 9, 17 and 20 to assess present lead concentrations in ground water at these wells. This factor may impact well placement and/or other aspects of the monitoring program.

The proposed monitoring program would consist of a multi-step field program. Four additional monitoring well clusters will be installed to develop a better understanding of the hydrogeologic system and to serve as monitoring points. The field program will consist of five elements to be conducted in the following order:

1. Install two upgradient well clusters of two each.
2. Survey elevations and install protective casings on selected wells.
3. Measure water levels in wells; assess ground-water flow conditions; install weirs and measure surface water discharge.

4. Install two downgradient monitoring well clusters based on ground-water flow (defined by previous activities).

5. Sample wells.

Figures 1 and 2 show the proposed locations of the monitoring well clusters and surface-water monitoring location. Figure 3 shows a typical clustered well installation.

The following specific items will be integrated into the program described above:

- o permeability testing
- o water balance calculations
- o review of data collected by Fuss and O'Neill on an adjacent site.

The rationale and goals of these program elements are summarized in Table 1.

Utilizing data collected from the field program discussed above and the wells installed in this program, the following sampling program is proposed for metals and non-priority pollutants at the site. It basically consists of establishing concentrations, then reducing or increasing sampling frequency if trigger points are reached. If high trigger points are reached, a remedial action program will be developed. The Sampling Program elements, their rationale and, objectives are summarized in Table 2.

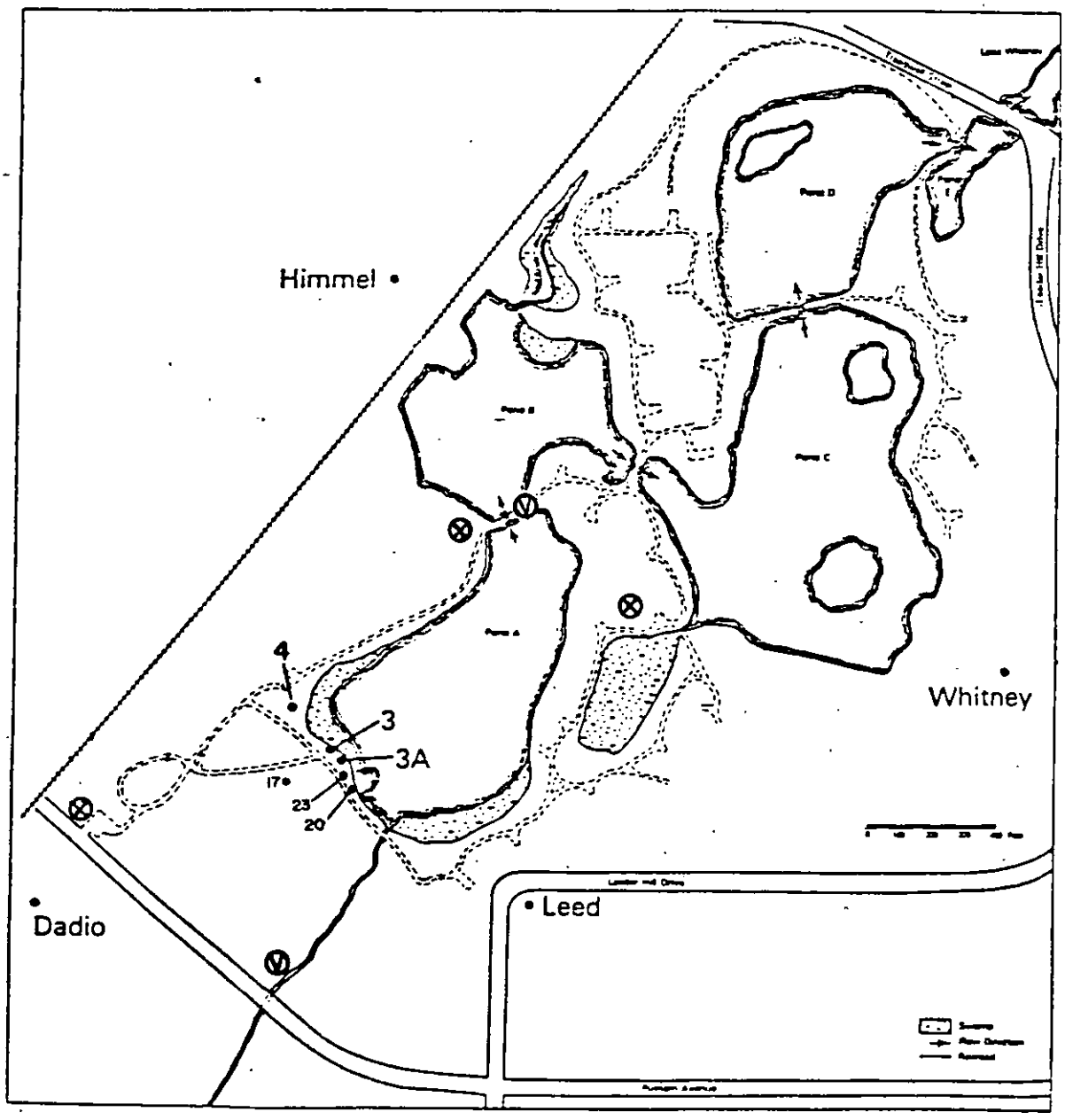

Figure 1 — Monitoring Location for selected heavy metals

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(courtesy of ERT)

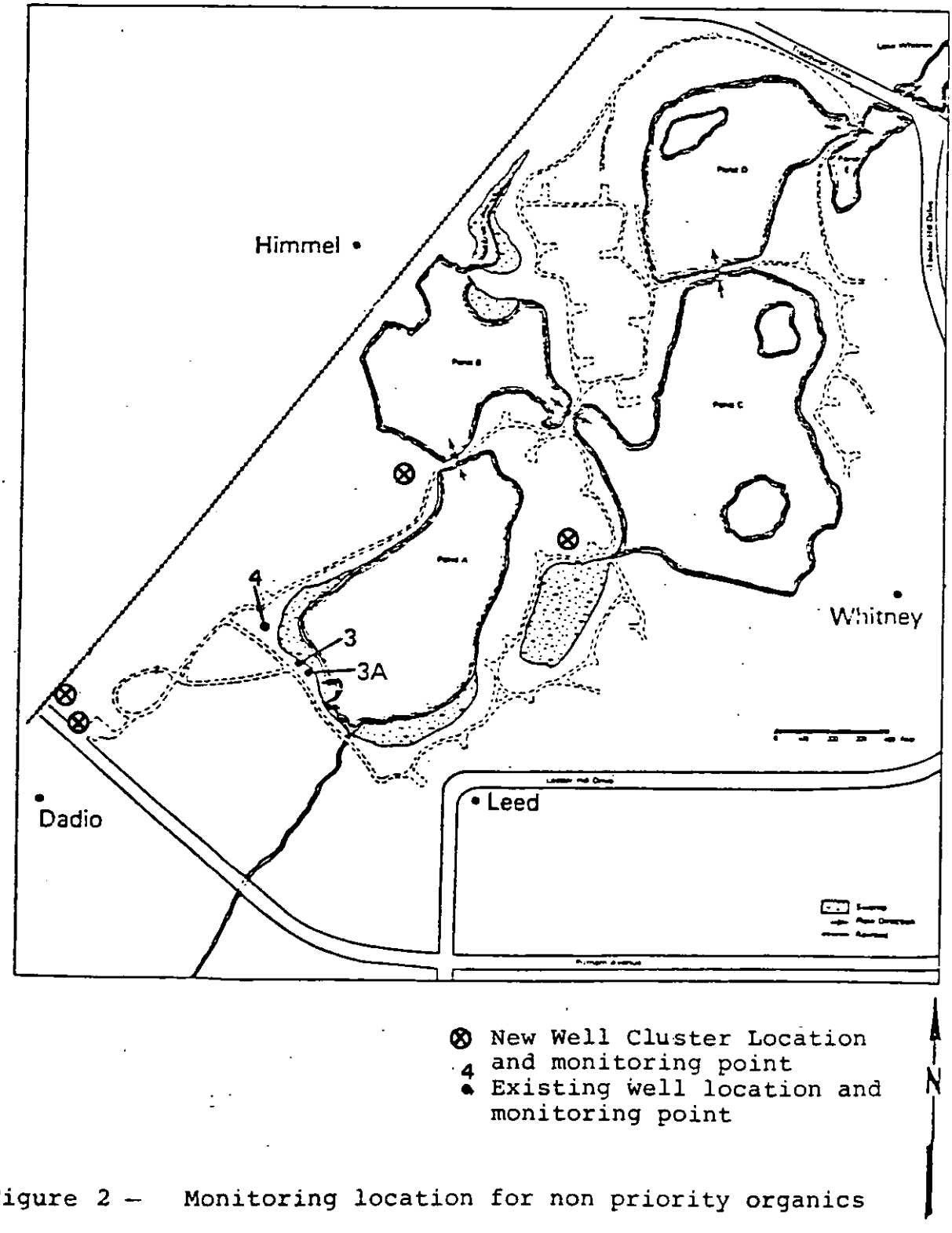

Figure 2 – Monitoring location for non priority organics

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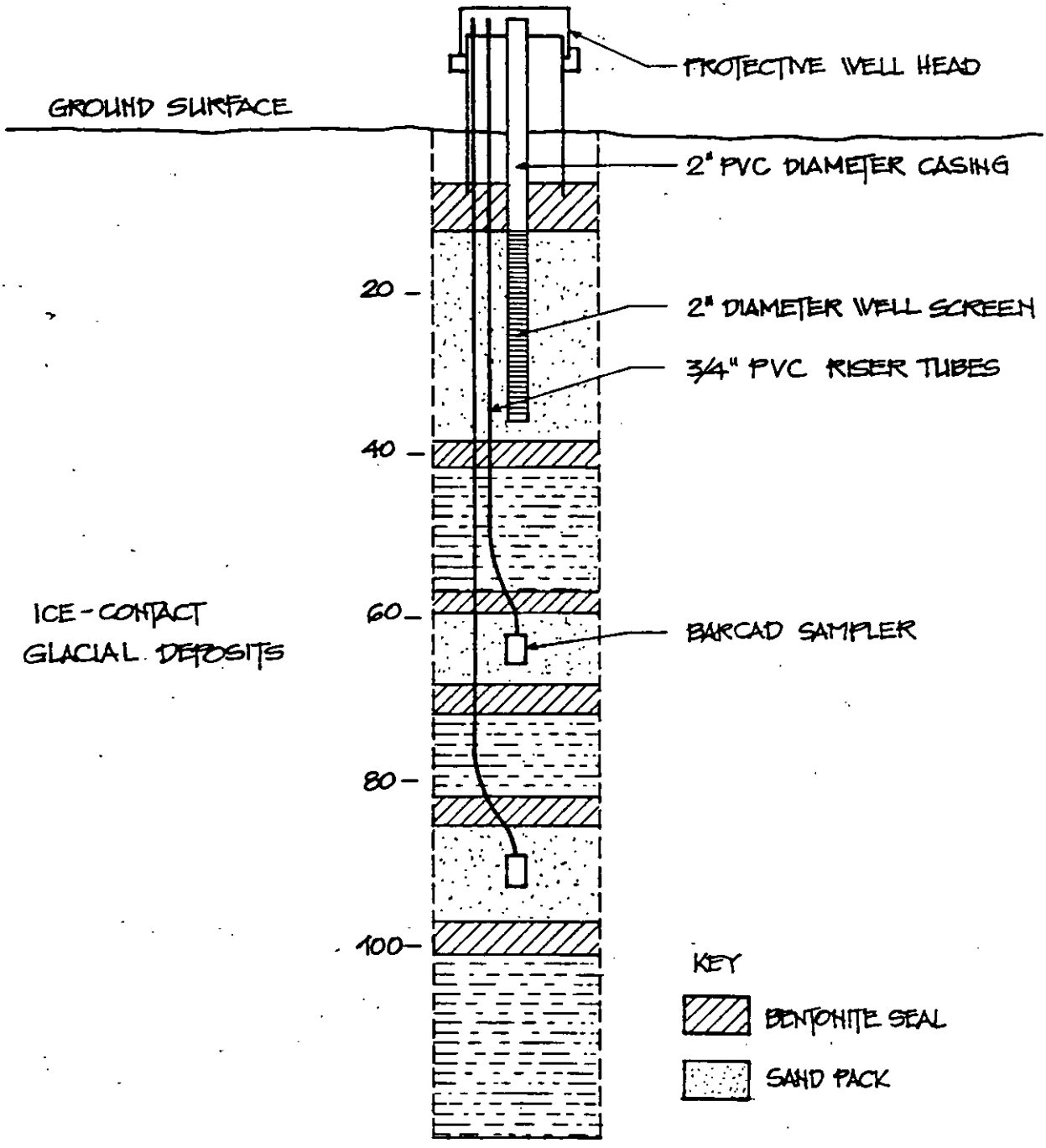
(courtesy of ERT)



MULTILEVEL PIEZOMETER INSTALLATION

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TABLE 1

MONITORING PROGRAM ELEMENTS, RATIONALE, AND OBJECTIVES

Field Acitivity	Flow Definition	Relationship to Monitoring Program	Resultant Action
Install upgradient clusters	Define deep and shallow flow components in the upgradient area	Determine background (i.e. upgradient) water quality	Define background conditions
Survey existing well elevations and install protective casings	To provide points for drawing flow net		Select sites for downgradient well clusters
Measure water levels in wells; assess flow conditions; install weirs and measure surface water discharge	Define flow conditions and assess relative importance of surface water vs. ground water discharge (via water balance)	Define potential contaminant migration routes	Select sites for downgradient well clusters Calculation of water balance
Install 2 downgradient clusters	Define deep and shallow flow components downgradient	Serve as downgradient monitoring points for both deep and shallow systems	Refine Monitoring Strategy
Permeability tests	Define rates of fluid movement	Establish schedule frequency evaluate effects of pumpage	Refine Monitoring Strategy
Installation and operation of continuous water level recorders	Record variations in water levels which may be correlated to precipitation or or pumpage	Evaluate effects of precipitation and local pumpage on the system (very low gradients and very high permeability system)	Refine Monitoring Strategy

TABLE 2

MONITORING PROGRAM ELEMENTS, RATIONALE, AND OBJECTIVES

Sampling Elements	Flow Definition	Monitoring Program	Resultant Action
Metals			
2 surface water sites	To determine if metals are moving from battery area in sufficient concentrations to impact ground-water quality	Sample biannually o Sample annually	If metal concentrations conform to primary drinking water standards on 3 successive events (3 years) - Decrease frequency to annual
2 new downgradient clusters	o compliance points		If 3 successive samples comply with standards - Terminate sampling
existing wells	o compliance points		
3	o deep sample below area		
3A	o sample just beneath area		
4	o well with high value previously		If any concentrations exceed primary standards - Increase to quarterly frequency
23	o well with high value previously		
17	o well with high value previously		
20	o sample just beneath area		
			If concentrations exceed primary standards for 3 successive events - Develop remedial action program
Analyze Pb, Cd, Zn, Mn			
1 new upgradient cluster	o upgradient ground-water conditions		Definition of upgradient water-quality conditions

TABLE 2

MONITORING PROGRAM ELEMENTS, RATIONALE, AND OBJECTIVES
(continued)

Sampling Elements	Flow Definition	Monitoring Program	Resultant Action
Non-Priority Pollutants Organics			
2 surface water sites 2 new upgradient clusters existing wells 3 3A 4 16 2 new downgradient clusters Analyze for TBA and THF	To monitor contaminant presence, concentration, and migration o to determine upgradient water quality o compliance points		If TBA and THF concentrations do not exceed 10 mg/l for 3 successive events - Decrease frequency to annual If TBA and THF concentrations are less than 5 mg/l for 3 successive sampling events - Terminate sampling If TBA and THF concentrations exceed 10 mg/l for any sampling event - Increase to quarterly frequency If TBA and THF concentrations exceed 10 mg/l for 3 successive sampling events - Develop remedial action program